Compost Use for Landscape and Environmental Enhancement

Janet Hartin

University of California Cooperative Extension

jshartin@ucdavis.edu

Principles of Sustainable Landscaping

- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Principles of Sustainable Landscaping

- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Use USDA or Sunset Zones

Microclimates

Principles of Sustainable Landscaping

- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Good (top) and Poor (bottom) Distribution Uniformity

CA Department of Water Resources Proposed Water Budget

MAWA* = (ETo) (0.7) (LA) (0.62)

ETo = Reference Evapotranspiration (inches per year)

0.7 = ET Adjustment Factor

LA = Landscaped Area (square feet)

0.62 = Conversion factor (to gallons)

***Maximum Applied Water Allowance = ____ gallons/year**

Example of Maximum Applied Water Allowance (MAWA)

- Southern California (annual historical ETo = 51.1 in)
- Hypothetical Landscape Area = 50,000 sq ft
- MAWA = (Eto) (0.7)* (LA) (0.62)**
- MAWA = (51.1) (0.7) (50,000 sq ft) (0.62)
- MAWA = 1,108,870 gallons per year

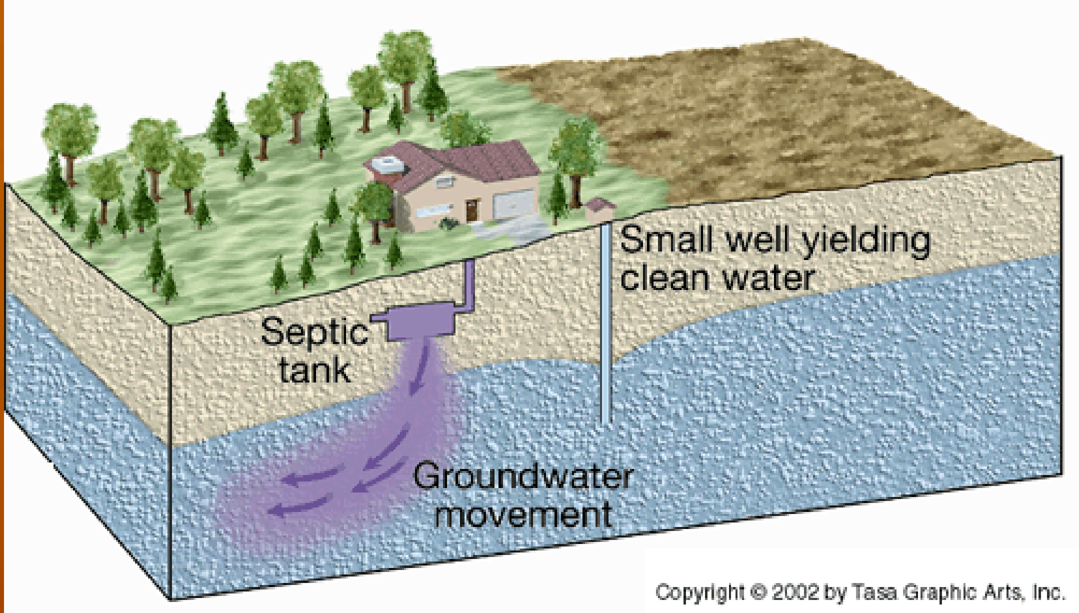
*ET Adjustment Factor

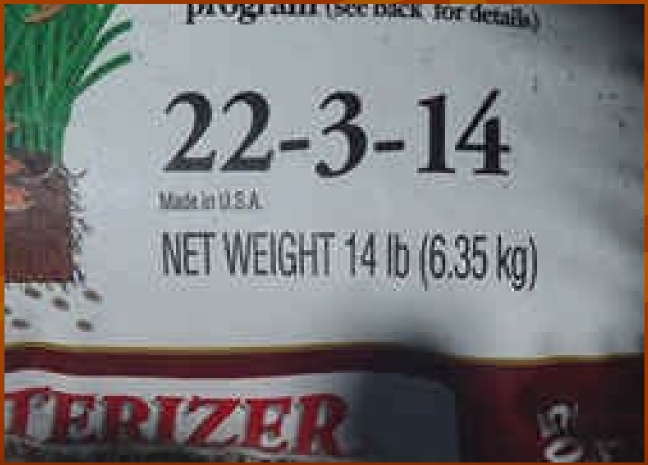
** Conversion factor from inches to gallons

Principles of Sustainable Landscaping

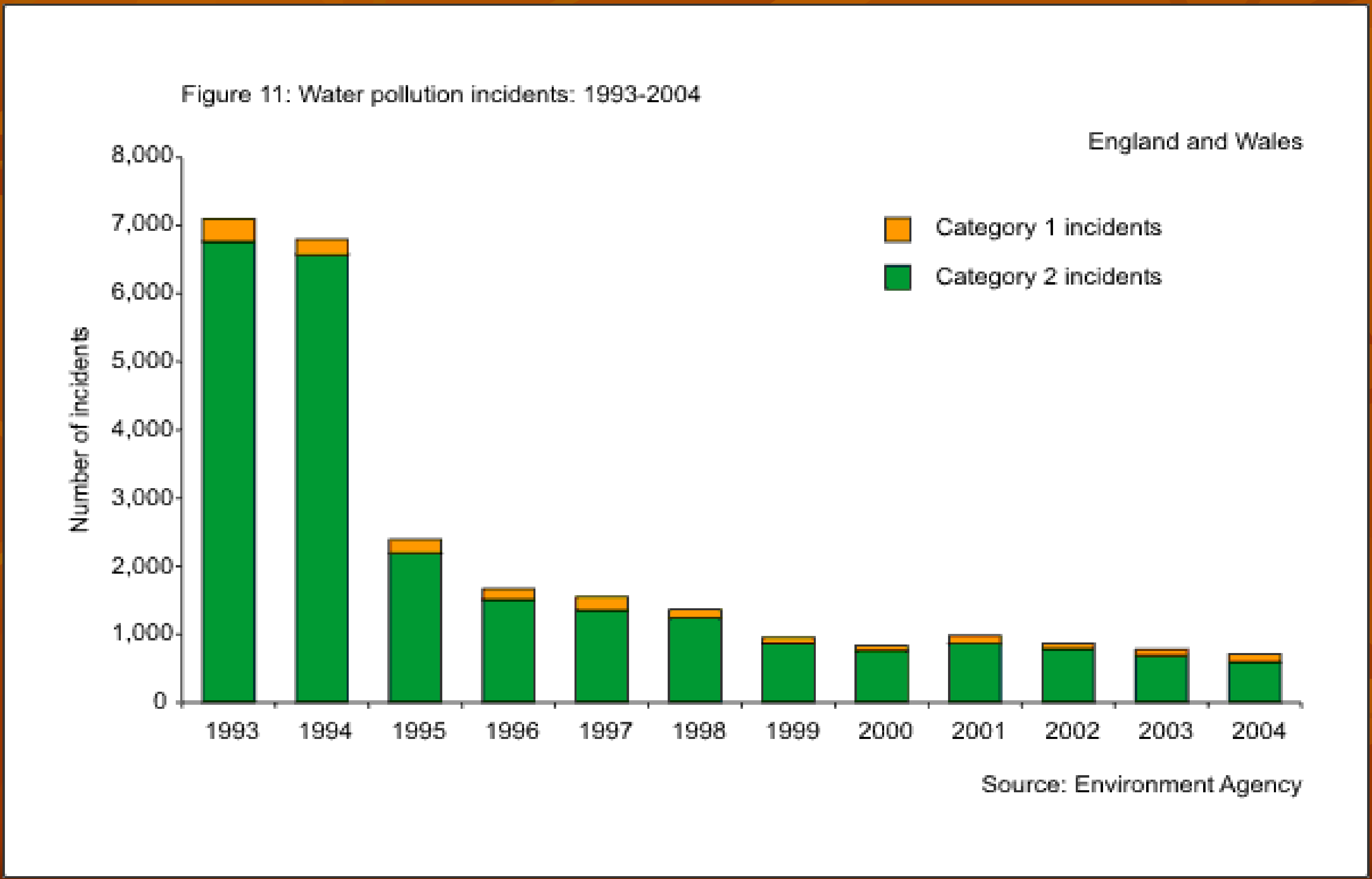
- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Schematic diagram showing a home septic tank
polluting groundwater while a small upgradient well yields clean water.





Water Pollution Incidents: 1993-2004



Previous slide is a graph showing occurrences from 1993-2004 of Category 1 and 2 pollution incidents in Wales and England

- The x axis presents years 1993 to 2004
- The y axis presents the number of incidents from 0 to 8,000.
  - For each year, the majority of incidents (~ 90%) were category 2; in other words, only a small percent were category 1 incidents.
  - In 1993 and 1994, there were approx. 7,000 incidents.
  - In 1995, the incidents dropped significantly to approx. 2,500.
  - From 1996 to 1989, the incidents continued to decline to about 1,500 per year.
  - From 1999 to 2004, the incident amount remained steady at approx. 1,000 incidents per year.

Principles of Sustainable Landscaping

- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Beneficial insect:
beetle eating pea aphid.

Disease suppression: 4 flats with seedlings, each labeled “compost 1” etc. The flat of “compost 3” shows best disease suppression (most living plants).

Principles of Sustainable Landscaping

- Climatically/microclimatically Selected Plants
- Water Efficient/Hydrozoned
- Pollution Friendly (water quality, noise, dust)
- Employs Integrated Pest Management
- Reduces, Recycles, and Reuses Greenwaste

Composting

It's Recycling…

Naturally

Composting Yard Wastes

- In California, yard wastes are the largest component of municipal waste
- Grass clippings comprise approximately half of the yard trimmings deposited in state landfills.
- An average California turf area produces 300 to 400 pounds of grass clippings per 1,000 square feet annually (up to 8 tons per acre).

One teaspoon of high quality soil amended with compost contains

- 100 million bacteria
- 800 feet of fungal threads

Soil Textures

Compost

- Improves soil tilth
- Improves water and nutrient holding capacity
- Improves drainage in heavy soils
- Prevents/reduces erosion
- Improves soil aeration
- May decrease chemical fertilizer requirement
- Remediates chemically damaged soils
- Increases number and range of microbes
- Filters storm water runoff

Compost is Not a Fertilizer

- Nitrogen and phosphorus are mostly in organic forms
  - Released slowly to plants
  - Not readily leached from the topsoil
- Compost contains many trace nutrients that are essential for plant growth

Compost Quality, Testing, and Use Standards

- End uses (eg: soil amendment, mulch) depend on compost physical, chemical, and biological qualities
- Selecting the right product very important for success
- Fortunately, standards have been developed to guarantee product consistency

US Composting Council Quality Assurance

- During the 1990's labs used different testing procedures and tests that were not comparable among labs
- Standardized testing procedures developed in 2000

Three Components:

- TMECC: Test Methods for the Evaluation of Composting and Compost
- STA: Seal of Testing Assurance Program
- CAP: Compost Analysis Proficiency Program

TMECC

- Developed standard operating procedures for how composts should be collected and prepared

- Describes laboratory reporting procedures in detail (bulk density, moisture content, etc.)

Compost Analysis Proficiency (CAP)

- Is a program that standardizes laboratory analysis and reporting
- Ensures accuracy

Seal of Testing Assurance (STA)

- Helps composters build credibility and a steady clientele
- Participating composters collect and submit samples to STA certified laboratories to ensure consistency in testing and quality

Association of Compost Producers (ACP) Compost Use Index

- Collaboration of the Association of Compost Producers and University of California for indexing composts based on their suitability for various uses
- Includes 14 test parameters

Compost Uses in the Landscape

- Soil Amendment
- Mulch
- Turf topdressing
- Erosion Control Agent
- Water Quality Enhancer

Soil Amendment

- Most common landscape use
- Turf, groundcovers, shrubs, annual and perennial beds
- Not recommended for tree planting sites

Avoid root bound trees!

Result of Circled Roots

Amending Soil With Compost

- Amend entire planting site or bed when possible, adding at least 30% compost to original soil
- Or, dig hole at least 3 times the size of root ball
- Thoroughly mix compost at least 6 inches deep
- Plant at original depth (not too deep)
- Irrigate immediately and deeply

Soil Amendments for Chemical Remediation

- California soils tend to be alkaline
- Neutral composts can reduce a high pH over time
- Addition of sulfur (elemental sulfur, iron sulfate or ammonium sulfate) may also be necessary
- Sodic soils can be improved with gypsum (calcium sulfate)

Sample Application Process

- Evenly apply 1-2 inch layer of compost (3-6 cubic years per 1,000 sq ft) to top of soil
- Incorporate evenly 6 inches to one foot deep
- Smooth soil surface before planting
- Irrigate deeply and thoroughly after planting

Compost Criteria for Use as Soil Amendment

- 95% should clear a 5/8” screen and at least 70% should clear a 3/8” screen
- Organic Matter content: 30 – 65%
- C:N ratio: 20:1 or lower
- pH: 6.0 – 8.5
- Soluble Salts: sodium less than 25% of total

Criteria (Con'd)

- Moisture content: 30 – 60%
- Contaminants: (glass, plastic, metal) less than .5% by weight
- Maturity: Dark color and no offensive odor

Soil Amendments for Turf Establishment

- Evenly apply a 1-2 inch layer of compost (3-6 cubic yards per 1,000 square feet)
- Use a front-end loader, tractor w/grading blade, or wheelbarrow and rake
- Incorporate to a depth of 4-6 inches and smooth surface
- Seed, sod, or sprig turf and irrigate thoroughly

Composted Greenwaste used as a Bermudagrass Soil Amendment

Figure 1. Composted greenwaste prior to amending into native sandy loam soil at University of California, Riverside.

Figure 2. Appearance of representative plots after topdressing, leveling, incorporating, and rolling.

Results: Visual Quality

Treatment	Year 1	Year 2	Year 3
0.49 ($m^3\ m^{-3}$), no traffic	5.6	6.3	6.2
0.39, no traffic	5.5	6.3	6.1
0.25, no traffic	5.5	6.2	6.1
No amendment, no traffic	5.5	6.0	6.0
0.49 with traffic	5.5	6.1	6.0
0.39 with traffic	5.4	6.0	5.9
0.25 with traffic	5.5	5.7	5.9
No amendment, with traffic	5.4	5.2	5.7
LSD	0.2	0.2	0.2

Results: Infiltration Rates

Treatment	cm h^{-1}
0.49 (m^3 m^{-3}), no traffic	8.6
0.39, no traffic	4.8
0.25, no traffic	4.0
No amendment, no traffic	3.6
0.49 with traffic	2.5
0.39 with traffic	1.8
0.25 with traffic	0.8
No amendment, with traffic	0.7
LSD	2.5

Results: Biomass

Treatment	g m^{-2}
0.49 (m^3 m^{-3}), no traffic	1297
0.39, no traffic	1278
0.25, no traffic	1208
No amendment, no traffic	1159
0.49 with traffic	1147
0.39 with traffic	1134
0.25 with traffic	1068
No amendment, with traffic	922
LSD	110

Conclusions

Bermuda plots amended with the largest volume of greenwaste compost applied (0.49 m3 m-3) resulted in higher visual quality, greater infiltration rates and greater plant biomass than unamended controls. By the end of the study, all compost treatments resulted in higher quality ratings than plots receiving no amendments with traffic.

Brown Patch (Rhizoctonia)

Mulch

- Reduces water evaporation from soil
- Buffers soil temperature
- Reduces weeds
- Prevents mechanical weed whip damage

Mixed Landscapes Benefit from Mulches


www.usbr.gov/lc/region/g4000/wtrconsv.html



Before


After

Before

After

Compost Criteria When Used as a Mulch

- Apply 2-3 inches on top of soil (6-9 cubic yards per 1,000 square feet)
- Carefully spread compost around the base of plants using a shovel or rake
- Avoid applications close to tree trunks
- Apply outward toward dripline

Thank You

Janet Hartin
951.313.2023
jshartin@ucdavis.edu

Composted greenwaste used as a bermudagrass soil amendment

- *J.S. Hartin[1], S.B. Ries[2], S.T. Cockerham[2]*
- *and V.A. Gibeault[3]*

- *[1]UC Cooperative Extension, [2]UC Riverside Agricultural Operations , [3]UC Riverside Botany and Plant Sciences*

Different quality athletic fields

There are few published data indicating the optimum volume and specific benefits of composted organic materials used for this purpose. Previous research indicates that, in general, organic soil amendments increase water and nutrient retention of sandy soils (Hartz et al.,1996; Laganiere et al.,1995) and may enhance drought resistance (Miller, 2000). Organic soil amendments added to coarse-textured soils may also increase the diversity of pore sizes leading to a more gradual water release (McCoy, 1992).

Objectives of this portion of our 3-year research project were to measure the effect of three volumes of composted greenwaste applied as a soil amendment to establishing common bermudagrass on:

- **Visual quality**
- **Total plant biomass**
- **Water infiltration**

Figure 1. Composted greenwaste stockpiled before amending into native sandy loam soil.

Three rates of composted greenwaste (0.24, 0.39 and 0.49 m^3 m^{-3} final volume) were incorporated into the top 10 cm of a sandy loam soil in early August 2000. The C:N ratio was 10:26; CEC 38.8 meq/100 g; pH 7.6; EC 30.2 mmhos/cm and SAR 18.8. A randomized complete block experimental design with six replicates in two plots was used. An unamended control was included. Arizona common bermudagrass (*Cyonodon dactylon* L) was seeded 2 weeks later at 9.8 g m^{-2}.

Simulated traffic treatments using a Brinkman traffic simulator began in May 2001 by subjecting assigned split-plot treatments to 3 passes every 2 weeks. Plots were irrigated at 80% of historic reference (ETo), adjusted on a monthly basis. Fertilizer was applied during the growing season to all treatments at a total rate of 24.4g N $m^{-2}yr^{-1}$.

Turfgrass visual quality was measured every 2 to 4 weeks monthly (except January). Surface hardness and compaction resistance*, total plant mass, water infiltration rates, and surface elevations* were measured 2 to 3 times annually. Infiltration was quantified using a static head, double ring infiltrometer in two locations per plot. Oven-dried plant mass was measured after removing soil from one 5 cm- diameter x 10 cm-deep soil core per treatment plot.

***not included here**

Figure 2. Representative plots after topdressing, leveling, incorporating, and rolling.

Results

During the initial 12 months of the study:

- There were no differences in visual quality between traffic and no traffic treatments receiving the same volume of composted amendment
  - Visual quality of all treatments was lower than at the end of Year 3

Treatment	Year 1	Year 2	Year 3
0.49 (m^3 m^{-3}) no traffic	5.6	6.3	6.2
0.39 no traffic	5.5	6.3	6.1
0.25 no traffic	5.5	6.2	6.1
No amendment no traffic	5.5	6.0	6.0
0.49 with traffic	5.5	6.1	6.0
0.39 with traffic	5.4	6.0	5.9
0.25 with traffic	5.5	5.7	5.9
No amendment with traffic	5.4	5.2	5.7
LSD	0.2	0.2	0.2

Table 1. Mean visual turfgrass quality on a 1-9 scale (9 = highest)

Treatment	cm h^{-1}
0.49 (m^3 m^{-3}) no traffic	8.6
0.39 no traffic	4.8
0.25 no traffic	4.0
No amendment no traffic	3.6
0.49 with traffic	2.5
0.39 with traffic	1.8
0.25 with traffic	0.8
No amendment with traffic	0.7
LSD	2.5

Table 2. Infiltration rate (cm hr^{-1}) (Dec. '01, Aug. '02, Dec. '02, Aug, '03, Nov.'03)

Treatment	$g\ m^{-2}$
0.49 ($m^3\ m^{-3}$) no traffic	1297
0.39 no traffic	1278
0.25 no traffic	1208
No amendment no traffic	1159
0.49 with traffic	1147
0.39 with traffic	1134
0.25 with traffic	1068
No amendment with traffic	922
LSD	110

Table 3. Total plant biomass ($g\ m^{-2}$ to 10 cm depth)
(June '01, Sept. '01, June '02, Oct.'02, June '03, Sept. '03)

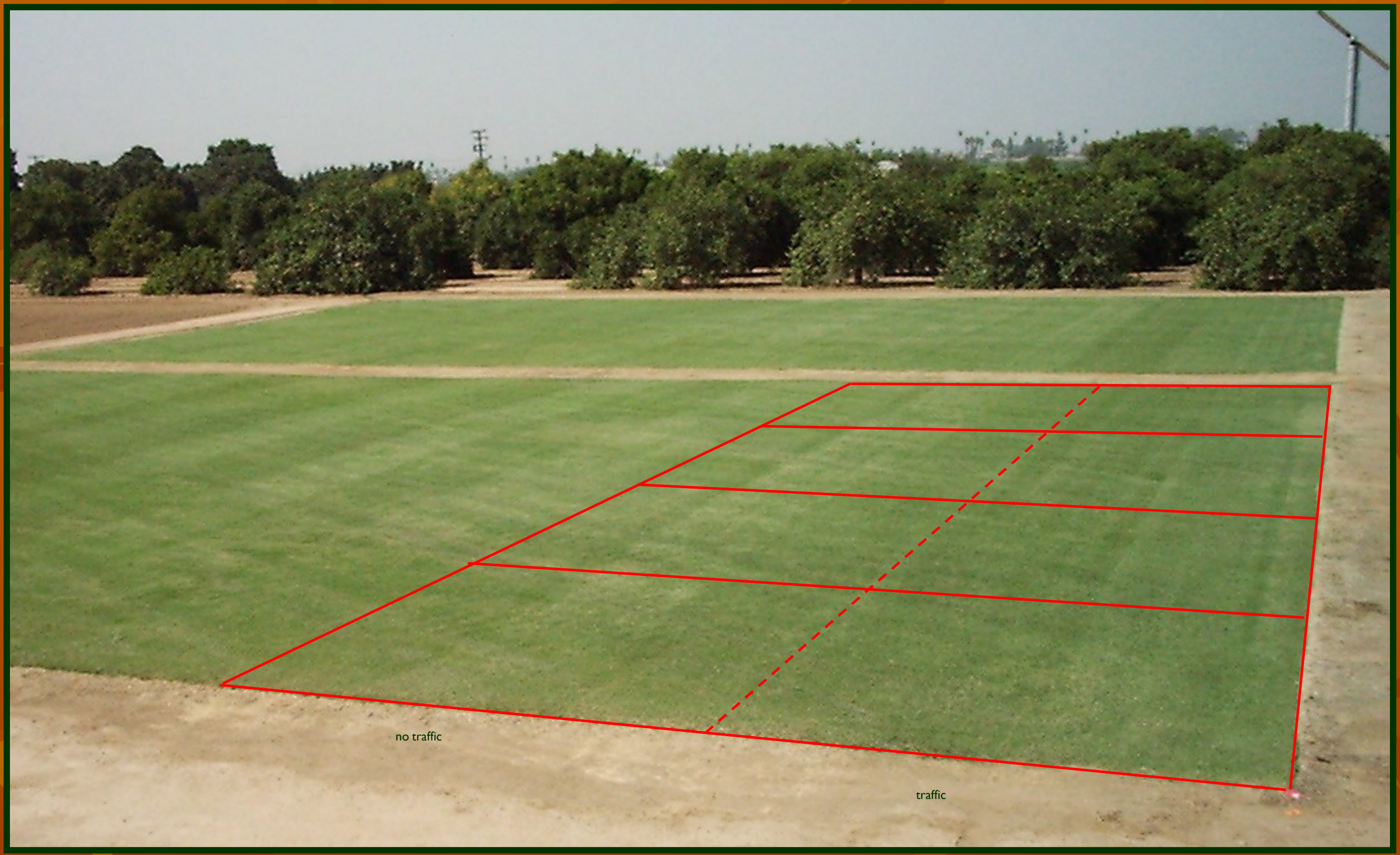


Figure 4. One block of amended plots receiving traffic vs no traffic the first year (July '02).

Conclusions

In this study, amending soil with composted greenwaste generally resulted in higher bermudagrass turfgrass visual quality and greater infiltration rates and total plant biomass than resulted in unamended controls. The highest volume of amendment applied (0.49 m^3 m^{-3}) did not reduce visual quality, infiltration rate, or total plant biomass potentially increasing the market for greenwaste compost as a turfgrass soil amendment and leading to greater landfill diversion of these organic materials.

Additional research comparing the combined effects of different depths and volumes of organic matter incorporation on visual quality, plant biomass and infiltration rates of bermudagrass plantings subjected to varying levels of traffic simulation would further define recommended standards.

Topdress with Compost

Janet Hartin
jshartin@ucdavis.edu
(951) 313-2023